

IN THE CLAIMS

Claims 11-20 are hereby represented unamended.

11. (original) An injector for a vacuum die-casting apparatus, comprising: an injector body which encloses a containment chamber for containing injection material and is provided with at least one first opening for loading molten material in said chamber and at least one second opening for injecting in and, respectively, aspirating protective gas from said chamber, said first and second openings being arranged on said injector body in order of operation; an injection piston movable with a sliding motion in said chamber for pushing the molten material into a die of the die-casting apparatus, said piston comprising an external surface and a head end thereof; a supporting element, which is arranged separate from, and coaxial to said chamber and acts as a guide and support for the piston during motion thereof among a retracted position, in which the head end is arranged at the supporting element, and advanced positions, in which the piston advances in the chamber to allow loading of molten material in said chamber and for injecting the loaded molten material, respectively, and back to the retracted position; cleaning and lubricating means arranged in order of operation on said supporting element so as to provide cleaning and lubricating of the whole external surface of the piston upon movement thereof among said retracted and, respectively, said advanced positions.

12. (original) The injector of claim 11, wherein said supporting element is constituted by a plate-like element for guiding and supporting the piston, which has a circumferential groove that is arranged radially to the piston .

13. (original) The injector of claim 12, wherein said cleaning means is constituted by a scraper ring provided with circumferential lips having a saw-tooth cross-sectional shape, which is located at said supporting element.

14. (original) The injector of claim 13, wherein said lubricating means are constituted by at least one lubricant injection nozzle which is arranged at said groove of the supporting element, radially with respect to the piston .

15. (original) The injector of claim 14, wherein said scraper ring is arranged downstream of said groove with respect to an advancement direction of the piston.

16. (original) The injector of claim 15, wherein said second opening is arranged downstream of said first opening with respect to the piston advancement direction.

17. (original) The injector of claim 16, further comprising a pressurized protective-gas circuit connected to said second opening.

18. (original) An injector for a vacuum die-casting apparatus, comprising: an injector body which encloses a containment chamber for containing injection material and is provided with at least one first opening for loading molten material in said chamber and at least one second opening for injecting in and, respectively, aspirating protective gas from said chamber, said first and second openings being arranged on said injector body in order of operation; an injection piston movable with a sliding motion in said chamber for pushing the molten material into a die of the die-casting apparatus, said piston comprising an external surface and a head end thereof; a supporting element, which is arranged separate from, and coaxial to said chamber and acts as a guide and support for the piston during motion thereof among a retracted position, in which the head end is arranged at the supporting element, and advanced positions, in which the piston advances in the chamber to allow loading of molten material in said chamber and for injecting the loaded molten material in the die, respectively, and back to the retracted position, said supporting means being constituted by a plate-like element which has a circumferential groove that is arranged radially to the piston; lubricating means for lubricating the external surface of the piston, which is constituted by at least one lubricant injection nozzle arranged at said groove of the supporting element, radially with respect to the piston; and cleaning means for cleaning the external surface of the piston, which is constituted by a scraper ring provided with circumferential lips having a saw-tooth cross-sectional shape, said lubricating and cleaning means being located at said supporting element, arranged in order of operation so as to provide cleaning and lubricating of the whole external surface of the piston upon movement thereof among said retracted and, respectively, said advanced positions.

19. (original) The injector of claim 18, wherein said scraper ring is arranged downstream of said groove with respect to an advancement direction of the piston.

20. (original) A method for injection of molten material in a die of a vacuum die-casting apparatus, comprising the steps of:

-providing an injector comprising an injector body enclosing a containment chamber for containing injection material which is provided with at least one first opening for loading molten material in said chamber and at least one second opening for injecting in and, respectively, aspirating protective gas from said chamber, the first and second openings being arranged on said injector body in order of operation, an injection piston movable with a sliding motion in said chamber for pushing the molten material into a die of the die-casting apparatus, the piston comprising an external surface and a head end thereof, a supporting element arranged separate from, and coaxial to the chamber and acting as a guide and support for the piston during movement thereof, and cleaning and lubricating means arranged in order of operation on the supporting element so as to provide cleaning and lubricating of the whole external surface of the piston;

- connecting the injector, in a material injection configuration, with a die of a die-casting apparatus;
- moving the piston from a retracted position, in which the head end thereof is arranged at the supporting element, to an advanced position in the containment chamber, in which the piston allows loading of molten material in said containment chamber through said first opening;
- introducing material in a molten state, in a protective-gas atmosphere, in the containment chamber of the injector body, while the piston is motionless in said advanced position for a controlled time period;
- aspirating protective gas from said chamber through said second opening until a vacuum is generated in the die and in the chamber;
- moving the piston to a further advanced position in said containment chamber for injecting the molten material into the die;
- lubricating the external surface of the piston during advancement thereof;
- holding the piston in the further advanced position to allow cooling of the molten material injected in the die; and
- retracting the piston to the retracted position, with the head end arranged at the supporting element, while carrying out a complete cleaning of the external surface thereof by way of the cleaning means.